IN THE CLAIMS:

1. (Original) A power source, power converter, and radio and microwave generator comprising an energy cell for the catalysis of atomic hydrogen to form novel hydrogen species and compositions of matter comprising new forms of hydrogen, an applied magnetic field, and at least one antenna that receives power from a plasma formed by the catalysis of hydrogen.

2. (Original) The power source, power converter, and radio and microwave generator of claim 2 wherein the electrons and ions of the plasma orbit in a circular path in a plane transverse to the applied magnetic field for sufficient field strength at an ion cyclotron frequency ω_c that is independent of the velocity of the ion.

3. (Original) The power source, power converter, and radio and microwave generator of claim 1 wherein the ions emit electromagnetic radiation with a maximum intensity at the cyclotron frequency.

4. (Original) The power source, power converter, and radio and microwave generator of claim 1 wherein the electromagnetic radiation emitted from the ions is received by at least one resonant receiving antenna and delivered to an electrical load such as a resistive load or radiated as a source of radio or microwaves.

5. (Original) The compound of claim 1 comprising

(a) at least one neutral, positive, or negative increased binding energy hydrogen species having a binding energy

(i) greater than the binding energy of the corresponding ordinary hydrogen species, or

(ii) greater than the binding energy of any hydrogen species for which the corresponding ordinary hydrogen species is unstable or is not observed because the

ordinary hydrogen species' binding energy is less than thermal energies at ambient conditions, or is negative; and

(b) at least one other element.

6. (Original) A compound of claim 1 or 5 characterized in that the increased binding energy hydrogen species is selected from the group consisting of H_n, H_n^-, and H_n^+ where n is a positive integer, with the proviso that n is greater than 1 when H has a positive charge.

7. (Original) A compound of claim 1 characterized in that the increased binding energy hydrogen species is selected from the group consisting of (a) hydride ion having a binding energy that is greater than the binding of ordinary hydride ion (about 0.8 eV) for $p = 2$ up to 23 in which the binding energy is represented by

$$Binding\ Energy = \frac{\hbar^2\sqrt{s(s+1)}}{8\mu_e a_0^2\left[\frac{1+\sqrt{s(s+1)}}{p}\right]^2} - \frac{\pi\mu_0 e^2\hbar^2}{m_e^2 a_0^3}\left(1+\frac{2^2}{\left[\frac{1+\sqrt{s(s+1)}}{p}\right]^3}\right)$$

where p is an integer greater than one, $s = 1/2$, π is pi, $\hbar$ is Planck's constant bar, μ_o is the permeability of vacuum, m_e is the mass of the electron, μ_e is the reduced electron mass, a_o is the Bohr radius, and e is the elementary charge; (b) hydrogen atom having a binding energy greater than about 13.6 eV; (c) hydrogen molecule having a first binding energy greater than about 15.5 eV; and (d) molecular hydrogen ion having a binding energy greater than about 16.4 eV.

8. (Original) A compound of claim 7 characterized in that the increased binding energy hydrogen species is a hydride ion having a binding energy of about 3.0, 6.6, 11.2, 16.7, 22.8, 29.3, 36.1, 42.8, 49.4, 55.5, 61.0, 65.6, 69.2, 71.5, 72.4, 71.5, 68.8, 64.0, 56.8, 47.1, 34.6, 19.2, or 0.65 eV.

9. (Original) A compound of claim 8 characterized in that the increased binding energy hydrogen species is a hydride ion having the binding energy:

$$Binding\ Energy = \frac{\hbar^2\sqrt{s(s+1)}}{8\mu_e a_0^2\left[\frac{1+\sqrt{s(s+1)}}{p}\right]^2} - \frac{\pi\mu_0 e^2\hbar^2}{m_e^2 a_0^3}\left(1+\frac{2^2}{\left[\frac{1+\sqrt{s(s+1)}}{p}\right]^3}\right)$$

where p is an integer greater than one, $s = 1/2$, π is pi, $\hbar$ is Planck's constant bar, μ_o is the permeability of vacuum, m_e is the mass of the electron, μ_e is the reduced electron mass, a_o is the Bohr radius, and e is the elementary charge.

10. (Original) A compound of claim 1 characterized in that the increased binding energy hydrogen species is selected from the group consisting of

(a) a hydrogen atom having a binding energy of about $\frac{13.6\ eV}{\left(\frac{1}{p}\right)^2}$ where p is an integer,

(b) an increased binding energy hydride ion (H^-) having a binding energy of about $\frac{\hbar^2\sqrt{s(s+1)}}{8\mu_e a_0^2\left[\frac{1+\sqrt{s(s+1)}}{p}\right]^2} - \frac{\pi\mu_0 e^2\hbar^2}{m_e^2 a_0^3}\left(1+\frac{2^2}{\left[\frac{1+\sqrt{s(s+1)}}{p}\right]^3}\right)$ where $s = 1/2$, π is pi, $\hbar$ is Planck's constant bar, μ_o is the permeability of vacuum, m_e is the mass of the electron, μ_e is the reduced electron mass, a_o is the Bohr radius, and e is the elementary charge;

(c) an increased binding energy hydrogen species $H_4^+(1/p)$;

(d) an increased binding energy hydrogen species trihydrino molecular ion, $H_3^+(1/p)$, having a binding energy of about $\frac{22.6}{\left(\frac{1}{p}\right)^2}\ eV$ where p is an integer,

(e) an increased binding energy hydrogen molecule having a binding energy of about $\frac{15.5}{\left(\frac{1}{p}\right)^2} eV$; and

(f) an increased binding energy hydrogen molecular ion with a binding energy of about $\frac{16.4}{\left(\frac{1}{p}\right)^2} eV$.

11. (Previously Presented) A cyclotron comprising:

a cell for containing ions formed by catalysis of hydrogen during operation of the cyclotron, wherein the hydrogen catalysis comprises a reaction between hydrogen atoms and a catalyst having a net enthalpy of reaction of about m/2 x 27.2 eV, where m is an integer greater than 1, that releases energy from the hydrogen atoms and forms hydrogen atoms having lower energy states;

a source of the hydrogen in communication with the cell;

a source of the catalyst in communication with the cell;

a source of a magnetic field constructed and arranged for producing a magnetic field during operation of the cell for causing the ions formed by the reaction of the hydrogen and the catalyst to orbit in the cell; and

at least one antenna constructed and arranged for receiving power from the ions during operation of the cell.

12. (Previously Presented) A cyclotron according to claim 11, further comprising a resistive load connected to the at least one antenna.

13. (Previously Presented) A cyclotron according to claim 11, wherein the source of magnetic field produces a constant magnetic field.

14. (Previously Presented) A cyclotron according to claim 11, wherein the source of

magnetic field comprises an electromagnet.

15. (Previously Presented) A cyclotron according to claim 11, wherein the source of magnetic field comprises a permanent magnetic.

16. (Previously Presented) A cyclotron according to claim 11, wherein the source of magnetic field comprises a superconductor.

17. (Previously Presented) A cyclotron according to claim 11, wherein the source of magnetic field is constructed and arranged to a provide a longitudinally magnetic field.

18. (Previously Presented) A cyclotron according to claim 11, wherein the source of magnetic field is constructed and arranged to a provide a magnetic field parallel to a discharge electric field.

19. (Previously Presented) A cyclotron according to claim 11, wherein the cell and source of magnetic field are constructed and arranged such that during operation of the cell ions orbit in a circular path in a plane transverse to the magnetic field for sufficient field strength at an ion cyclotron frequency ω_c that is independent of the velocity of the ion.

20. (Previously Presented) A cyclotron according to claim 11, wherein the antenna is tuned such that during operation the ions comprise electrons in a plasma and the antenna is tuned to receive power emitted by the electrons.

21. (Previously Presented) A power source according to claim 1, further comprising an electromagnet for producing the applied magnetic field.

22. (Previously Presented) A power source according to claim 1, further comprising a permanent magnet for producing the applied magnetic field.

23. (Previously Presented) A power source according to claim 1, further comprising a superconductor for producing the applied magnetic field.

24. (Previously Presented) A power source according to claim 1, wherein the applied magnetic field comprises longitudinally magnetic field.

25. (Previously Presented) A power source according to claim 1, wherein the applied magnetic field is parallel to a discharge electric field.

26. (Previously Presented) A power source according to claim 1, wherein the energy cell and applied magnetic field are constructed and arranged such that when operating, ions of the plasma orbit in a circular path in a plane transverse to the applied magnetic field for sufficient field strength at an ion cyclotron frequency ω_c that is independent of the velocity of the ion.

27. (Previously Presented) A power source according to claim 1, wherein the antenna is tuned such that during operation electrons are produced in a plasma and the antenna is tuned to receive power emitted by the electrons.

28. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, further comprising an oscillator circuit in communication with the antenna.

29. (Previously Presented) A cyclotron or power source according to claim 28, wherein the circuit is constructed and arranged to provide a voltage that varies sinusoidally about a central value.

30. (Previously Presented) A cyclotron or power source according to claim 28, wherein the circuit comprises at least two parallel plates situated between pole faces of a magnet.

31. (Previously Presented) A cyclotron or power source according to any one of claims 1 and 11, wherein the cell comprises a tunable resonator cavity.

32. (Previously Presented) A cyclotron or power source according to any one of claims 1 and 11, wherein the cell comprises a tunable waveguide.

33. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, further comprising a source of an electric field in the cell.

34. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, further comprising a source of an electric field in the cell constructed and arranged for adjusting a rate of catalysis of hydrogen during operation of the cell.

35. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, further comprising a source of an electric field in the cell constructed and arranged for focusing ions in the cell during operation.

36. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, further comprising a source of an electric field in the cell constructed and arranged for imparting a drift velocity to ions during operation.

37. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, further comprising a converter for converting power received by the antenna during operation into electrical power.

38. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, wherein the antenna comprises one or more coils.

39. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, wherein the antenna comprises one or more coils located circumferentially about the cell to receive power in a direction of applied magnetic field during operation.

40. (Previously Presented) A cyclotron according to claim 38, further comprising an electrical load for receiving electrical power from the antenna.

41. (Previously Presented) A cyclotron according to claim 39, further comprising an electrical load for receiving electrical power from the antenna.

42. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, further comprising at least one photovoltaic cell for converting light generated during operation of the cell into electrical power.

43. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, further comprising at least two spatially separated electrodes that comprise conducting materials of differing Fermi energies or ionization energies, such that during operation power from hydrogen catalysis causes ionization at one electrode to a greater extent relative to another electrode such that a voltage exists between the electrodes.

44. (Previously Presented) A cyclotron or power source according to claim 43, wherein at least two electrodes are at opposite sides of the cell.

45. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, wherein the antenna is tuned to receive electromagnetic radiation produced during operation of the cell.

46. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, wherein the antenna is tuned to receive electromagnetic radiation produced during operation of the cell such that the antenna has a receiving frequency that is resonate with a cyclotron frequency of at least one orbiting ion species during operation.

47. (Previously Presented) A cyclotron or power source according to claim 46, further comprising a converter for converting the received electromagnetic radiation into electricity.

48. (Previously Presented) A cyclotron or power source according to claim 47, further comprising a converter for converting the received electromagnetic radiation into electricity.

49. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, wherein the antenna comprises a receiving and emitting antenna such that the antenna is constructed and arranged to receive electromagnetic radiation produced during operation of the cell and transmit or broadcast the electromagnetic radiation away from the cell.

50. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, further comprising a cyclotron resonance spectrometer constructed and arranged for analyzing ions formed during operation.

51. (Previously Presented) A cyclotron or power source according to one of claims 1

and 11, further comprising a rectifer in communication with the antenna for rectifying the power output.

52. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, wherein the cyclotron or power source comprises a magnetron.

53. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, wherein the cyclotron or power source comprises a Cherenkov device.

54. (Previously Presented) A cyclotron or power source according to claim 53, wherein the device comprises a traveling-wave tube.

55. (Previously Presented) A cyclotron or power source according to claim 53, wherein the device comprises a backward wave oscillator.

56. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, wherein the cyclotron or power source comprises a Smith-Purcell device.

57. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, wherein the cyclotron or power source comprises a Klystron device.

58. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, wherein the cyclotron or power source comprises a deflection-modulation device.

59. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, wherein the cyclotron or power source comprises a scanning-beam device.

60. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, wherein the cyclotron or power source comprises a gyrocon device.

61. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, wherein the cyclotron or power source comprises a bremsstrahlung device.

62. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, wherein the cyclotron or power source comprises a cyclotron resonance maser device.

63. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, wherein the cyclotron or power source comprises a smooth anode magnetron device.

64. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, wherein the cyclotron or power source comprises a phasochronous device.

65. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, wherein the cyclotron or power source comprises a cyclostron autoresonance maser device.

66. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, wherein the cyclotron or power source comprises a relativistic gyrotron device.

67. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, wherein the cyclotron or power source comprises an axisymetric gyrotron

device.

68. (Previously Presented) A cyclotron or power source according to claim 67, wherein the axisymetric gyrotron device comprises a cathode and a solenoid.

69. (Previously Presented) A cyclotron or power source according to claim 67, wherein the axisymetric gyrotron device comprises a magnetic mirror.

70. (Previously Presented) A cyclotron or power source according to claim 67, wherein the axisymetric gyrotron device comprises a reversed magnetic mirror.

71. (Previously Presented) A cyclotron or power source according to claim 67, wherein the axisymetric gyrotron device comprises an extended surface collector.

72. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, wherein the cyclotron or power source comprises a gyrotron autogenerator device.

73. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, wherein the cyclotron or power source comprises a magnetic induction power converter device.

74. (Previously Presented) A cyclotron or power source according to claim 73, comprising at least one coil for producing a time dependent voltage, the coil being constructed and arranged to have a plane perpendicular to magnetic flux of the applied magnetic field or provided by the source of magnetic field.

75. (Previously Presented) A cyclotron or power source according to one of claims 1

and 11, further comprising a source of an electric field that is constructed and arranged to modulate an intensity of the catalysis reaction over time.

76. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, further comprising a photovoltaic power converter and at least one phosphor for converting short wavelength light to longer wavelength light, wherein the photovoltaic power converter is constructed and arranged to receive light from the cell.

77. (Previously Presented) A cyclotron or power source according to one of claims 1 and 11, wherein the catalyst comprises at least one metal atom selected from the group consisting of Li, Be, K, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Kr, Rb, Sr, Nb, Mo, Pd, Sn, Te, Cs, Pr, Sm, Gd, Dy, Pb, and Pt.

78. (Previously Presented) A cyclotron according to claim 11, wherein the cell is further constructed and arranged to produce a compound comprising:

(a) at least one neutral, positive, or negative increased binding energy hydrogen species having a binding energy

(i) greater than the binding energy of the corresponding ordinary hydrogen species, or

(ii) greater than the binding energy of any hydrogen species for which the corresponding ordinary hydrogen species is unstable or is not observed because the ordinary hydrogen species' binding energy is less than thermal energies at ambient conditions, or is negative; and

(b) at least one other element.

79. (Previously Presented) A cyclotron according to claim 78, wherein the increased binding energy hydrogen species is selected from the group consisting of H_n, H_n^-, and H_n^+ where n is a positive integer, with the proviso that n is greater than 1

when H has a positive charge.

80. (Previously Presented) A cyclotron according to claim 78, wherein the increased binding energy hydrogen species is selected from the group consisting of (a) hydride ion having a binding energy that is greater than the binding of ordinary hydride ion (about 0.8 eV) for $p = 2$ up to 23 in which the binding energy is represented by

$$Binding\ Energy = \frac{\hbar^2\sqrt{s(s+1)}}{8\mu_e a_0^2\left[\frac{1+\sqrt{s(s+1)}}{p}\right]^2} - \frac{\pi\mu_0 e^2\hbar^2}{m_e^2 a_0^3}\left(1+\frac{2^2}{\left[\frac{1+\sqrt{s(s+1)}}{p}\right]^3}\right)$$

where p is an integer greater than one, $s = 1/2$, π is pi, $\hbar$ is Planck's constant bar, μ_o is the permeability of vacuum, m_e is the mass of the electron, μ_e is the reduced electron mass, a_o is the Bohr radius, and e is the elementary charge; (b) hydrogen atom having a binding energy greater than about 13.6 eV; (c) hydrogen molecule having a first binding energy greater than about 15.5 eV; and (d) molecular hydrogen ion having a binding energy greater than about 16.4 eV.

81. (Previously Presented) A cyclotron according to claim 78, wherein the increased binding energy hydrogen species is a hydride ion having a binding energy of about 3.0, 6.6, 11.2, 16.7, 22.8, 29.3, 36.1, 42.8, 49.4, 55.5, 61.0, 65.6, 69.2, 71.5, 72.4, 71.5, 68.8, 64.0, 56.8, 47.1, 34.6, 19.2, or 0.65 eV.

82. (Previously Presented) A cyclotron according to claim 78, wherein the increased binding energy hydrogen species is a hydride ion having the binding energy:

$$Binding\ Energy = \frac{\hbar^2\sqrt{s(s+1)}}{8\mu_e a_0^2\left[\frac{1+\sqrt{s(s+1)}}{p}\right]^2} - \frac{\pi\mu_0 e^2\hbar^2}{m_e^2 a_0^3}\left(1+\frac{2^2}{\left[\frac{1+\sqrt{s(s+1)}}{p}\right]^3}\right)$$

where p is an integer greater than one, $s = 1/2$, π is pi, $\hbar$ is Planck's constant bar, μ_o is the permeability of vacuum, m_e is the mass of the electron, μ_e is the reduced electron mass, a_o is the Bohr radius, and e is the elementary charge.

83. (Previously Presented) A cyclotron according to claim 11, wherein the cell is constructed and arranged to provide an increased binding energy hydrogen species selected from the group consisting of :

(a) a hydrogen atom having a binding energy of about $\frac{13.6\ eV}{\left(\frac{1}{p}\right)^2}$ where p is an integer,

(b) an increased binding energy hydride ion (H^-) having a binding energy of about $\frac{\hbar^2\sqrt{s(s+1)}}{8\mu_e a_0^2\left[\frac{1+\sqrt{s(s+1)}}{p}\right]^2} - \frac{\pi\mu_0 e^2\hbar^2}{m_e^2 a_0^3}\left(1+\frac{2^2}{\left[\frac{1+\sqrt{s(s+1)}}{p}\right]^3}\right)$ where $s = 1/2$, π is pi, $\hbar$ is Planck's constant bar, μ_o is the permeability of vacuum, m_e is the mass of the electron, μ_e is the reduced electron mass, a_o is the Bohr radius, and e is the elementary charge;

(c) an increased binding energy hydrogen species $H_4^+(1/p)$;

(d) an increased binding energy hydrogen species trihydrino molecular ion, $H_3^+(1/p)$, having a binding energy of about $\frac{22.6}{\left(\frac{1}{p}\right)^2}\ eV$ where p is an integer,

(e) an increased binding energy hydrogen molecule having a binding energy of about $\frac{15.5}{\left(\frac{1}{p}\right)^2} eV$; and

(f) an increased binding energy hydrogen molecular ion with a binding energy of about $\frac{16.4}{\left(\frac{1}{p}\right)^2} eV$.

84. (Previously Presented) A cyclotron according to claim 83, wherein the source of catalyst can produce a catalyst capable of providing a net enthalpy of $m \cdot 27.2 \pm 0.5\ eV$ where m is an integer or $m/2 \cdot 27.2 \pm 0.5\ eV$ where m is an integer greater than one.

85. (Previously Presented) A cyclotron according to claim 84, wherein m is an integer less than 400.

86. (Previously Presented) A cyclotron according to claim 11, further comprising a hydrogen supply tube and a hydrogen supply passage to supply hydrogen gas to the vessel.

87. (Previously Presented) A cyclotron according to claim 11, further comprising a hydrogen flow controller and valve to control the flow of hydrogen to the chamber.

88. (Previously Presented) A cyclotron according to claim 11, further comprising an anode and a hydrogen permeable hollow cathode of an electrolysis cell as the source of hydrogen communicating with the chamber that delivers hydrogen to the chamber through a hydrogen supply passage.

89. (Previously Presented) A cyclotron according to claim 11, further comprising a vacuum pump and vacuum lines connected to the cell.

90. (Previously Presented) A cyclotron according to claim 89, wherein the vacuum pump is constructed and arranged to evacuate the vessel through the vacuum lines.

91. (Previously Presented) A cyclotron according to claim 11, further comprising gas flow means constructed and arranged to supply hydrogen and catalyst continuously from the catalyst source and the hydrogen source.

92. (Previously Presented) A cyclotron according to claim 11, further comprising a catalyst reservoir and a catalyst supply passage for the passage of catalyst from the reservoir to the vessel.

93. (Previously Presented) A cyclotron according to claim 92, further comprising a catalyst reservoir heater and a power supply to heat the catalyst in the catalyst reservoir to provide the gaseous catalyst.

94. (Previously Presented) A cyclotron according to claim 92, further comprising a temperature control means wherein the vapor pressure of the catalyst can be controlled by controlling the temperature of the catalyst reservoir.

95. (Previously Presented) A cyclotron according to claim 11, further comprising a chemically resistant open container located inside the vessel which contains the source of catalyst.

96. (Previously Presented) A cyclotron according to claim 95, wherein the chemically

resistant open container comprises a ceramic boat.

97. (Previously Presented) A cyclotron according to claim 96, further comprising a heater for obtaining or maintaining an elevated cell temperature such that the source of catalyst in the boat is sublimed, boiled, or volatilized into the gas phase.

98. (Previously Presented) A cyclotron according to claim 96, further comprising a boat heater, and a power supply for heating the source of catalyst in the boat to provide gaseous catalyst to the vessel.

99. (Previously Presented) A cyclotron according to claim 96, further comprising a temperature control means wherein the vapor pressure of the catalyst can be controlled by controlling the temperature of the boat.

100. (Previously Presented) A cyclotron according to claim 11, further comprising a vacuum pump in communication with the trap for causing a pressure gradient from the vessel to the trap for causing gas flow and transport of a lower-energy hydrogen species or lower-energy hydrogen compound.

101. (Previously Presented) A cyclotron according to claim 100, further comprising a passage from the vessel to the trap and a vacuum line from the trap to the pump, and further comprising valves to and from the trap.

102. (Currently Amended) <u>A</u> cyclotron according to claim 11, wherein the cell comprises at least one material selected from <u>the</u> group consisting of stainless steel, molybdenum, tungsten, glass, quartz, and ceramic.

103. (Previously Presented) A cyclotron according to claim 11, further comprising at

least one selected from the group consisting of an aspirator, atomizer, or nebulizer, for forming an aerosol of the source of catalyst.

104. (Previously Presented) A cyclotron according to claim 103, wherein the aspirator, atomizer, or nebulizer are constructed and arranged for injecting the source of catalyst or catalyst directly into the plasma during operation.

105. (Previously Presented) A cyclotron according to claim 11, wherein the cell is constructed and arranged such that during operation a catalyst or source of catalyst is agitated from a source of catalyst and supplied to the vessel through a flowing gas stream.

106. (Previously Presented) A cyclotron according to claim 105, wherein the flowing gas stream comprises hydrogen gas or plasma gas which may be an additional source of catalyst.

107. (Previously Presented) A cyclotron according to claim 11, wherein the source of catalyst is dissolved or suspended in a liquid medium.

108. (Previously Presented) A cyclotron according to claim 107, wherein the cell is further constructed and arranged such that the source of catalyst is dissolved or suspended in a liquid medium and aerosolized during operation of the cell.

109. (Previously Presented) A method of making power using a cyclotron comprising a cell, a source of hydrogen in communication with the cell, a source of catalyst having a net enthalpy of reaction of about m x 27.2 eV, where m is an integer, in communication with the cell, a source of a magnetic field, and at least one antenna, the method comprising:

supplying hydrogen atoms to the cell;

supplying catalyst to the cell having a net enthalpy of reaction of about m x 27.2 eV, where m is an integer, wherein a hydrogen catalysis reaction occurs between the hydrogen atoms and the catalyst that releases energy from the hydrogen atoms and forms hydrogen atoms having lower energy states, the energy release being sufficient to form a non-thermal plasma comprising ions;

applying a magnetic field to the plasma for causing the ions to orbit in the cell; and

receiving power from the orbiting ions using the antenna.

110. (Previously Presented) A method according to claim 109, further comprising applying a resistive load the one antenna.

111. (Previously Presented) A method according to claim 109, further comprising applying a constant magnetic field to the ions.

112. (Previously Presented) A method according to claim 109, wherein the magnetic field is applied using an electromagnet.

113. (Previously Presented) A method according to claim 109, wherein the magnetic field is applied using a permanent magnetic.

114. (Previously Presented) A method according to claim 109, wherein the magnetic field is applied using a superconductor.

115. (Previously Presented) A method according to claim 109, wherein a longitudinally magnetic field is applied to the ions.

116. (Previously Presented) A method according to claim 109, further comprising

applying a magnetic field parallel to a discharge electric field.

117. (Previously Presented) A method according to claim 109, wherein the magnetic field is applied such that ions orbit in a circular path in a plane transverse to the magnetic field for sufficient field strength at an ion cyclotron frequency ω_c that is independent of the velocity of the ion.

118. (Previously Presented) A method according to claim 109, wherein the ions comprise electrons and the antenna receives the electrons.

119. (Previously Presented) A method according to claim 109, wherein the total pressure of the cell is maintained such that the ions have a sufficient mean free path to emit radiation to the antenna.

120. (Previously Presented) A method according to claim 109, further comprising using an oscillator circuit in communication with the antenna to receive power from the ions.

121. (Previously Presented) A method according to claim 120, wherein the oscillator circuit provides a voltage that varies sinusoidally about a central value.

122. (Previously Presented) A method according to claim 120, wherein the circuit comprises at least two parallel plates situated between pole faces of a magnet and the alternating electric field due to the orbiting ions is normal to the magnetic field.

123. (Previously Presented) A method according to claim 109, wherein the cell comprises a tunable resonator cavity.

124. (Previously Presented) A method according to claim 109, wherein the cell comprises a tunable waveguide.

125. (Previously Presented) A method according to claim 109, further comprising supplying an electric field in the cell.

126. (Previously Presented) A method according to claim 125, wherein the electric field in the range of 0.1 to 10^4 V/m.

127. (Previously Presented) A method according to claim 125, wherein the electric field in the range of 1 to 10^3 V/m.

128. (Previously Presented) A method according to claim 109, further comprising supplying an electric field in the cell for adjusting a rate of catalysis of hydrogen.

129. (Previously Presented) A method according to claim 109, further comprising supplying an electric field in the cell for focusing the ions in the cell.

130. (Previously Presented) A method according to claim 109, further comprising supplying an electric field in the cell for imparting a drift velocity to the ions.

131. (Previously Presented) A method according to claim 109, further comprising converting power received by the antenna into electrical power.

132. (Previously Presented) A method according to claim 109, wherein the antenna comprises one or more coils.

133. (Previously Presented) A method according to claim 109, wherein the antenna comprises one or more coils located circumferentially about the cell which

receive power in a direction of applied magnetic field during operation.

134. (Previously Presented) A method according to claim 109, further comprising an electrical load for receiving electrical power from the antenna.

135. (Previously Presented) A method according to claim 109, further comprising converting light into electrical power using at least one photovoltaic cell in communication with the cell.

136. (Previously Presented) A method according to claim 109, further comprising at least two spatially separated electrodes in the cell that comprise conducting materials of differing Fermi energies or ionization energies, creating a voltage between the electrodes by ionizing one electrode to a greater extent relative to another electrode.

137. (Previously Presented) A method according to claim 136, wherein at least two electrodes are at opposite sides of the cell.

138. (Previously Presented) A method according to claim 109, wherein the antenna receives electromagnetic radiation from the ions.

139. (Previously Presented) A method according to claim 109, wherein the antenna is tuned to receive electromagnetic radiation produced during operation of the cell such that the antenna has a receiving frequency that is resonate with a cyclotron frequency of at least one orbiting ion species.

140. (Previously Presented) A method according to claim 139, further comprising converting the received electromagnetic radiation into electricity using a converter.

141. (Previously Presented) A method according to claim 109, wherein the antenna comprises a receiving and emitting antenna such that the antenna receive electromagnetic radiation produced during operation of the cell and transmits or broadcasts the electromagnetic radiation away from the cell.

142. (Previously Presented) A method according to claim 109, further comprising analyzing ions formed during operation using a cyclotron resonance spectrometer.

143. (Previously Presented) A method according to claim 109, further comprising a rectifer in communication with the antenna for rectifying the power output.

144. (Previously Presented) A method according to claim 109, wherein the plasma temperature is in the range of 1,000K to over 100,000K.

145. (Previously Presented) A method according to claim 109, further comprising applying an external field to the cell to group ions to produce coherent radiation.

146. (Previously Presented) A method according to claim 109, wherein the cell is operated to produce coherent radiation from the action of a self-consistent field produced by the ions.

147. (Previously Presented) A method according to claim 109, wherein the cell is operated to produce microwaves.

148. (Previously Presented) A method according to claim 147, wherein the cell is operated to produce ions traveling predominately along a desired axis to form an ion beam.

149. (Previously Presented) A method according to claim 148, further comprising applying a field to adjust the flow of the ion beam.

150. (Previously Presented) A method according to claim 148, wherein the ions comprise electrons and the ion beam comprises an electron beam.

151. (Previously Presented) A method according to claim 150, wherein the ions comprise electrons and the ion beam comprises an electron beam.

152. (Previously Presented) A method according to claim 147, wherein the microwaves are coherent.

153. (Previously Presented) A method according to claim 109, wherein the cyclotron or power source comprises a magnetron having a cathode and an anode, further comprising converting potential energy of the ions into microwave power as the ions drift from the cathode to the anode.

154. (Previously Presented) A method according to claim 109, wherein the cyclotron or power source comprises a Cherenkov device in which the ions move in a medium with a refractive index of $n>1$, the ion velocity v is greater than the phase velocity of electromagnetic waves, $v_{ph} = c/n$, where c is the vacuum speed of light.

155. (Previously Presented) A method according to claim 154, wherein the device comprises a traveling-wave tube.

156. (Previously Presented) A method according to claim 154, wherein the device comprises a backward wave oscillator.

157. (Previously Presented) A method according to claim 109, wherein the cyclotron or power source comprises a Smith-Purcell device.

158. (Previously Presented) A method according to claim 109, wherein the cyclotron or power source comprises a Klystron device having one or more cavities separated by drift spaces, and further comprising forming ion bunches from an initially uniform ion flow by modulating the ion velocity using an axial electric field of a transverse magnetic mode, followed by an output cavity that produces coherent radiation by decelarating the ion bunches.

159. (Previously Presented) A method according to claim 109, wherein the cyclotron or power source comprises a deflection-modulation device having an input cavity, drift space and an output cavity, further comprising modulating ions in the input cavity using an input signal, drifting the ions across the drift space in a beam, which is free of microwaves, and decelarating an ion beam in an output cavity using microwave fields.

160. (Previously Presented) A method according to claim 159, wherein a linear ion beam is deflected by transverse fields of a rotating RF mode, the direction of the rotation rotates at the RF frequency, and after transit through an unmagnetized drift space, the transverse deflection produces a transverse displacement of the ion beam that enters the output cavity at an off-axis position that traverses a circle about the axis at the RF frequency.

161. (Previously Presented) A method according to claim 160, wherein the output cavity contains a mode which phase velocity about the axis is synchronous with a scanning motion of the ion beam.

162. (Previously Presented) A method according to claim 161, wherein the transverse size of the ion beam in the output cavity is smaller than the radiation wavelength.

163. (Previously Presented) A method according to claim 109, wherein the cyclotron comprises a scanning-beam device.

164. (Previously Presented) A method according to claim 109, wherein the cyclotron comprises a gyrocon device.

165. (Previously Presented) A method according to claim 109, wherein the cyclotron comprises a bremsstrahlung device in which the ions oscillate in external magnetic or electric fields.

166. (Previously Presented) A method according to claim 165, wherein ion oscillations are induced by constant or periodic fields.

167. (Previously Presented) A method according to claim 109, wherein the cyclotron comprises a cyclotron resonance maser device in which the ions oscillate in a constant magnetic field.

168. (Previously Presented) A method according to claim 109, wherein the cyclotron comprises a smooth anode magnetron device in which electrons are absorbed from an interaction space.

169. (Previously Presented) A method according to claim 109, wherein the cyclotron comprises a phasochronous device.

170. (Previously Presented) A method according to claim 109, wherein the cyclotron comprises a cyclostron autoresonance maser device.

171. (Previously Presented) A method according to claim 170, wherein an electromagnetic wave propagates in a direction of a static magnetic field with a phase velocity equal to the speed of light.

172. (Previously Presented) A method according to claim 109, wherein the cyclotron comprises a cyclotron resonance maser in which coherent radiation of electromagnetic waves is produced by ions rotating in a magnetic field.

173. (Previously Presented) A method according to claim 172, in which the magnetic field is non-homogeneous.

174. (Previously Presented) A method according to claim 109, wherein the cyclotron comprises a gyrotron.

175. (Previously Presented) A method according to claim 174, wherein a beam of ions are moving in a constant magnetic field and interact with electromagnetic waves excited in an irregular waveguide.

176. (Previously Presented) A method according to claim 174, wherein a beam of ions is moving in a non-homogenous magnetic field.

177. (Previously Presented) A method according to claim 109, wherein the cyclotron comprises a relativistic gyrotron device.

178. (Previously Presented) A method according to claim 177, in which an axially inhomogeneous magnetic field is applied.

179. (Previously Presented) A method according to claim 109, wherein the cyclotron

comprises a gyrotron in which the ions are relativistic and a variable magnetic field is used to decelerate the ions.

180. (Previously Presented) A method according to claim 109, wherein the cyclotron or power source comprises an axisymetric gyrotron device.

181. (Previously Presented) A method according to claim 180, wherein the axisymetric gyrotron device comprises a cathode and a solenoid.

182. (Previously Presented) A method according to claim 180, wherein the cathode produces an electric field to cause a drift for an intense flow of ions.

183. (Previously Presented) A method according to claim 182, wherein the flow of ions is compressed by a magnetic field which increases in intensity in the direction from the cathode to an interaction space.

184. (Previously Presented) A method according to claim 180, wherein the axisymetric gyrotron device comprises a magnetic mirror.

185. (Previously Presented) A method according to claim 180, wherein the axisymetric gyrotron device comprises a reversed magnetic mirror.

186. (Previously Presented) A method according to claim 185, wherein ions are guided by quasi-uniform magnetic fields in an interaction space and then leave the space entering a region of decreasing field and settle on an extended surface collector.

187. (Previously Presented) A method according to claim 180, wherein the axisymetric gyrotron device comprises an extended surface collector.

188. (Previously Presented) A method according to claim 109, wherein the cyclotron comprises a gyrotron autogenerator device.

189. (Previously Presented) A method according to claim 109, wherein the cyclotron comprises a gyrotron and interaction takes place in a smooth metal waveguide.

190. (Previously Presented) A method according to claim 189, wherein the cyclotron is operated such that the ions comprise nonrelativistic electrons having a high velocity dispersion and arbitrary orientation with respect to the applied magnetic field.

191. (Previously Presented) A method according to claim 109, wherein a nonuniform waveguide is excited near its cutoff frequency and is stable with respect to the ion velocity dispersion, when the ion energies are low.

192. (Previously Presented) A method according to claim 109, wherein the cyclotron is operated above its self-excitation threshold, the power is extracted from the ions by an RF field and transferred to a load using an output waveguide that couples the cavity to the load.

193. (Previously Presented) A method according to claim 192, wherein the coupling is accomplished using a cavity having a diffraction output for the RF field.

194. (Previously Presented) A method according to claim 192, wherein a wave transformer in the form of a corrugated waveguide is utilized.

195. (Previously Presented) A method according to claim 109, wherein the cyclotron comprises a magnetic induction power converter device.

196. (Previously Presented) A method according to claim 195, wherein power is received in a direction parallel to the direction of a magnetic flux.

197. (Previously Presented) A method according to claim 195, comprising at least one coil which produces a time dependent voltage, the coil being constructed and arranged to have a plane perpendicular to magnetic flux of the magnetic field.

198. (Previously Presented) A method according to claim 197, wherein the plasma is modulated in intensity with time.

199. (Previously Presented) A method according to claim 198, wherein the modulation is sinusoidal.

200. (Previously Presented) A method according to claim 199, wherein the modulation is sinusoidal at 60 Hz.

201. (Previously Presented) A method according to claim 198, wherein the modulation is achieved using an applied electric field to alter the catalysis rate.

202. (Previously Presented) A method according to claim 109, further comprising converting light produced in the hydrogen catalysis reaction into electricity using a photovoltaic power converter.

203. (Previously Presented) A method according to claim 202, further comprising converting a short wavelength light to longer wavelength light using a phosphor.

204. (Previously Presented) A method according to claim 109, wherein the catalyst comprises at least one metal atom selected from the group consisting of Li, Be,

K, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Kr, Rb, Sr, Nb, Mo, Pd, Sn, Te, Cs, Pr, Sm, Gd, Dy, Pb, and Pt.

205. (Previously Presented) A method according to claim 109, wherein the catalyst comprises at least one ion selected from the group consisting of He^{+}, Na^{+}, Rb^{+}, Fe^{3+}, Mo^{2+}, Mo^{4+} and In^{3+}.

206. (Previously Presented) A method of making lower energy hydrogen comprising reacting hydrogen atoms with at least one metal atom catalyst selected from the group consisting of Li, Be, K, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Kr, Rb, Sr, Nb, Mo, Pd, Sn, Te, Cs, Pr, Sm, Gd, Dy, Pb, and Pt.

207. (Previously Presented) A method of making lower energy hydrogen comprising reacting hydrogen atoms with at least one ion catalyst selected from the group consisting of He^{+}, Na^{+}, Rb^{+}, Fe^{3+}, Mo^{2+}, Mo^{4+} and In^{3+}.

208. (Previously Presented) A reactor for making lower-energy hydrogen comprising a vessel, a source of hydrogen atoms and a source of at least one metal atom catalyst selected from the group consisting of Li, Be, K, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Kr, Rb, Sr, Nb, Mo, Pd, Sn, Te, Cs, Pr, Sm, Gd, Dy, Pb, and Pt.

209. (Previously Presented) A reactor for making lower-energy hydrogen comprising a vessel, a source of hydrogen atoms and a source of at least one ion catalyst selected from the group consisting of He^{+}, Na^{+}, Rb^{+}, Fe^{3+}, Mo^{2+}, Mo^{4+} and In^{3+}.

210. (New) A method according to claim 109, wherein the catalyst comprises Li.